Body Dissatisfaction, Weight Criticism, and Self-Reported Physical Activity in Preadolescent Children

By

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Physical Activity in Preadolescent Children

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ABSTRACT

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The dramatic increase in the prevalence of pediatric overweight and obesity underscores the importance of efforts to increase physical activity levels among children. However, research has demonstrated that negative social interactions (i.e. weight criticism, peer victimization) can lead to lower levels of physical activity. In this study a community sample of 376 5th and 6th grade students completed measures of physical activity, weight criticism during physical activity, and body dissatisfaction. Girls who reported experiencing high levels of weight criticism and high body dissatisfaction engaged in significantly fewer vigorous activities than peers who experienced criticism in the absence of body dissatisfaction. These findings highlight the important role of body dissatisfaction in girl's propensity to engage in physical activity and lend support to prevention efforts designed to reduce body dissatisfaction and weight criticism among girls.

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Many people who have been instrumental in the completion of this project deserve recognition. First, my master's thesis chairperson, Ric Steele, has provided valuable direction and support during the conceptualization, implementation, and culmination of this project. This thesis is of far greater quality because of his mentorship. Second, Ann Davis and Michael Roberts, both members of my thesis committee, have provided valuable contributions and constructive feedback. Finally, my wife Amy and my daughter Emily deserve recognition for providing indispensable support and encouragement.

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The prevalence of childhood obesity, a condition commonly defined as Body Mass Index (BMI) percentile greater than or equal to the 95th percentile for age (American Medical Association, 2007), has increased dramatically in recent years. An epidemiological study conducted in 2003-2004 found that 17.1% of children and adolescents ages 2 to 19 were obese. Results from this study indicate that overweight prevalence tripled in children and adolescents ages 6 to19 between 1980 and 2002 (Ogden et al., 2006). When one considers the prevalence overweight (BMI $\geq$ 85th Percentile) among youths, this public health epidemic becomes increasingly troubling. Ogden and colleagues reported that an additional 16.5% of children are overweight. This report indicates that a full 33.6% of children and adolescents are either overweight or obese: over a third of all US children.

Health Consequences of Overweight

Physical health problems are among the many adverse consequences of overweight in children. Children and adolescents who are overweight are at elevated risk for hypertension and cardiovascular diseases. One study reports that overweight children are at approximately a 3-fold higher risk for hypertension than non-overweight children (Sorof & Daniels, 2002). Children with overweight have also been found to have higher levels of atherosclerosis, that is, a fat buildup in arteries that leads to further cardiovascular problems (Berenson et al., 1998). Additionally, overweight children have increased risk for elevated blood lipid levels, a risk factor

for later cardiovascular disease (Freedman, Srinivasan, Harsha, Webber, & Berenson, 1989). These cardiovascular risk factors combine to put overweight children at greater risk for mortality due to cardiovascular problems (Gunnell, Frankel, Nanchahal, Peters, & Smith, 1998). Overweight children are also at increased risk for obstructive sleep apnea. Amin et al. (2002) found that as BMI increased in children and adolescents, risk for sleep apnea increased. Overweight in childhood is also a strong predictor of metabolic syndrome in adulthood, putting these children at increased risk for development of diabetes later in life (Vanhala, Vanhala, Keinanen-Kiukaanniemi, Kumpusalo, & Takala, 1999). Finally, much of the increased prevalence of type 2 diabetes in youths has also been attributed to overweight during childhood and adolescence (Pinhas-Hamiel et al., 1996).

In addition to the physical health consequences of overweight in children, many psychosocial risks are correlated with overweight. These risks include increased depressive symptoms, decreased self-esteem, and increased peer victimization (see Zeller & Modi, in press, for a review). Clinical studies have found differences in prevalence of mood disorders between overweight and normal weight children, with higher incidence of mood problems in overweight children (Erermis et al., 2004; Zeller, Saelens, Roehrig, Kirk, & Daniels, 2004). Additionally, community-based research suggests that among preadolescent girls a modest association exists between BMI and depressive symptoms (Erickson, Robinson, Haydel, & Killen, 2000). Cross-sectional research also suggests that overweight adolescent girls are at significantly higher risk for suicide attempts, hopelessness, serious emotional

problems, and anxiety than their non-overweight peers (Falkner et al., 2001; Zametkin, Zoon, Klien, & Munson, 2004).

The physical and psychological health consequences of overweight are particularly alarming because studies consistently indicate that childhood weight remains fairly constant into adulthood (Whitaker, 1998; Field, Cook, & Gillman, 2005). Reviews of studies addressing the stability of overweight suggest that as many as two-thirds of all overweight children become overweight adults (He & Karlberg, 1999; Serdula et al., 1993). Thus, not only are overweight children subject to the health and psychological risks presented by overweight in youth, but many of them are at increased risk for mortality and morbidity in adulthood as well (Blair & Brodney, 1999).

Research concerning the health-related quality of life (HRQL) of overweight youths also demonstrates the deleterious effects of overweight. HRQL is a broad measure of physical, social, and emotional well being based on the person's subjective experience (Schipper, Clinch, & Olweny, 1996). Many investigators have documented the impairments that overweight children experience in daily functioning across HRQL domains compared to non-overweight youths (Fallon et al., 2005; Zeller & Modi, 2006). Underscoring these findings, Schwimmer, Burwinkle, and Varni (2003) demonstrated that overweight youths report similar HRQL to youths diagnosed with cancer. Qualitative impairments that contribute to this lower HRQL include poorer psychological well-being, lower self-esteem, fewer friends, greater school difficulties, and more family problems (Ravens-Sieberer, Redegeld, &

Bullingger, 2001).

Recent evidence also suggests that there are long term psychological correlates of childhood overweight that persist into adolescence and beyond. Two longitudinal studies have demonstrated that persistent obesity from childhood to adolescence was associated with decreasing self esteem and increases in other psychological problems. In one investigation, Strauss (2000) demonstrated that while no difference in self esteem existed between overweight and non-overweight children at age 9 to 10, by 13 to 14 years of age large differences in self-esteem appeared between overweight and non-overweight children. Additionally, these decreasing levels of self esteem were associated with significantly higher levels of sadness, loneliness, and nervousness when compared to those whose self esteem did not decrease. In another study, Brown and colleagues (1998) found that increases in BMI over time were associated with decreased individual perceptions of self-worth, physical appearance, and social acceptance, particularly as children transition into adolescence.

Finally, studies have also demonstrated a correlation between poor academic performance and overweight. For example, Datar, Sturm, and Magnabosco (2004) reported that overweight children in kindergarten and first grade have significantly lower math and reading scores than average weight peers. Similarly, Falkner and colleagues (2001) reported that academic problems are particularly prevalent among overweight girls. In this study, 42% of overweight females reported trouble getting along with other students at school, 12% perceived themselves as below average

students, 27% reported being held back a grade, and 35% expected not to finish college. Additionally, these authors indicated that overweight 7th, 9th, and 11th graders were more likely to report school problems, social relationship issues, and poor outlook for the future than non-overweight peers (Falkner et al., 2001).

Predictors/Causes of Pediatric Overweight

Although there is a genetic component to weight management problems (see Mair & McGarvey, in press), much of the increase in obesity among children and adolescents can be attributed to environmental or behavioral factors (Hill & Peters, 1998). Among environmental factors influencing weight control, the increase in average portion size of meals is considered a causal factor. Recent studies suggest that not only have the portion sizes in fast food establishments and restaurants increased (Young & Nestle, 2002), but corresponding increases in portion size of foods served in the home have occurred over the past 20 years (Nielsen & Popkin, 2003). While very young children appear to have relatively constant food intake independent of portion size, by age 4-5 children consume significantly more energy as portion size increases (Rolls, Engell, & Birch, 2000). One study investigating the increase in childhood caloric intake found that 4-year-old children ate 25% more when given a portion twice the age appropriate size than when given an appropriate portion (Fisher, Rolls, & Birch, 2003).

Another environmental or behavioral influence on weight control is physical activity level. Low levels of physical activity are associated with overweight in children and adolescents, a relationship that may be both a cause and consequence of

overweight (Moore, Nguyen, & Rothman, 1995). Conversely, high levels of physical activity promote weight control through increasing energy expenditure. A recent longitudinal study has illuminated the strong influence of physical activity on BMI, particularly among overweight children. Berkey, Rockett, Gillman, and Colditz (2003) demonstrated that among children ages 10-15, increases in physical activity were associated with decreases in BMI over a 1-year period for both girls and boys. Over the same time period, increases in *inactivity* were associated with increased BMI in girls. In all cases these relationships were stronger for overweight children, a finding that demonstrates the essential nature of physical activity when targeting weight control in overweight children. Additionally, physical activity increases muscle mass, thereby increasing resting energy expenditure (Goldberg, Prentice, & Davies, 1990). Thus, physical activity not only affects energy use when the child is active, but leads to higher caloric expenditure when sedentary as well.

Unfortunately, research suggests that physical activity is decreasing among children, a finding that mirrors the overall decrease in physical activity in the United States (Pratt, Macera, & Blanton, 1999). In addition to the declining levels of physical activity across ages, children engage in less physical activity as they increase in age. These declining levels of activity begin between the ages of 10 and 15, the time period thought to be critical in the development of overweight in adolescence (Caspersen, Pereira, & Curran, 2000; Spadano, Bandini, Must, Dallal, & Dietz, 2005). These findings suggest that at the times when physical activity could have the highest preventative importance, activity levels are actually declining.

Of the known influences on weight control in children, physical activity is one of the most logical targets for preventative action. An inherently alterable behavior, level of physical activity can directly affect weight control. Recent research has demonstrated that physical activity is one of the best predictors of BMI in preadolescent children. One longitudinal study conducted by Jago, Baranowski, Baranowski, Thompson, and Greaves (2005) demonstrated that physical activity was a strong predictor of weight gain between the ages of 3 and 6. Sedentary activity, specifically TV watching, was also a significant predictor of BMI. These relationships were shown to become stronger over time, becoming the strongest at 6 to 7 years of age.

Similarly, Moore and colleagues (2003) reported that in children ages 4 to 11, the most physically active children had significantly smaller increases in BMI between childhood and adolescence than those who were less active. Additionally, the children who were more physically active had a later age of adiposity rebound than less active children, a characteristic that decreases risk for obesity later in life. These effects were present for both boys and girls. The results of these studies are consistent with findings from the majority of investigations in this research area demonstrating the significant effects of physical activity on BMI in childhood and adolescence (Abbott & Davies, 2004; Dencker et al., 2006).

In summary, physical activity is an alterable behavior that directly influences weight management. The beneficial effects of physical activity are preventative, providing protection against development of weight control problems. Physical

activity also appears to be particularly critical between the ages of 6 and 7, the age when activity is shown to have the greatest effect on long term BMI. Because of the alarmingly high incidence of overweight in children, prevention efforts, including increasing physical activity, have great potential to reach more children than are currently being served and are better equipped to reach less-advantaged children, a population particularly vulnerable to overweight (Daniels et al., 2005). Although a large body of research has demonstrated the critical role of physical activity in weight management, less is known about the factors that promote increased activity. Understanding the factors that lead to physical activity or inactivity is critical to overweight prevention efforts.

Predictors/Correlates of Physical Activity

Several predictors and correlates of physical activity in pre-adolescent children have been elucidated by research from multiple disciplines. These correlates include socioeconomic status, parental physical activity levels, accessibility of safe activity venues, and participation in physical education classes at school. For example, Johnson et al. (1997) demonstrated that children from lower SES backgrounds engage in less physical activity than their higher SES peers. Perhaps partially explaining this finding, Gomez, Johnson, Selva, and Sallis (2004) reported that children who live in neighborhoods with higher rates of violent crime and neighborhood disorder engage in less physical activity than those in safer neighborhoods. As one might expect, children whose parents are less physically active tend to be less active themselves (Aarnio, Winter, Kujala, & Kaprio, 1997;

Perusse et al., 1989). These effects appear to be particularly strong among preadolescents between 7 and 12 years of age (Fogelholm, Nuutinen, Pasanen, Myohanan, & Saatela, 1999).

In addition to the aforementioned environmental and systemic predictors of physical activity (e.g., SES, activity level of parents, environmental safety), research suggests that negative peer interactions may also affect children's propensity for physical activity. Specifically, children's experience of weight criticism during physical activity (i.e., verbal comments directed at a child during physical activity that criticize the child's weight) has been implicated as a predictor of both children's physical activity level and enjoyment of sports and other physical activities (Faith, Leone, Ayers, Heo, & Pietrobelli, 2002). In a study of 576 fifth- through eighth-graders, Faith and colleagues found that weight related criticism during physical activity was associated with lower levels of physical activity. This relationship was stronger among girls and increased in magnitude as BMI increased. Children who experienced weight-related criticism during physical activity also reported lower enjoyment of sports. These results suggest that children who are targets of weight-related criticism, particularly while engaging in physical activity, are less likely to engage in such activity that non-overweight peers. Additionally, Faith and colleagues found that weight criticism becomes more prevalent as the child's BMI increases, potentially leading to lower levels of physical activity among the most overweight children.

In a similar investigation, Storch and colleagues (2007) found that among

children ages 8 to 18, peer victimization was negatively correlated with level of physical activity. Specifically, children who reported that they had been the targets of peer victimization also reported lower levels of physical activity when compared to non-victimized peers. Further, peer victimization among these children was also highly correlated with internalizing psychological symptoms (e.g. anxiety, loneliness, depression). Storch and colleagues suggested that victimized children may internalize the content of peer attacks, causing them to avoid situations (including physical activities) that have a high probability for victimization.

Findings from Faith et al. (2002) and Storch et al. (2007) represent significant steps in the study of predictors of children's physical activity. Together, results of these studies suggest that peer relationships, particularly teasing and victimization from others, lead to decreased levels of physical activity. These studies have also have led to an increased understanding of possible moderators of this relationship. Specific strengths of these studies include their large community-based samples, their focus on the unique effects of criticism *during* physical activity, and their examination of potential mediators and moderators of the relationship between physical activity and peer criticism.

However, despite these strengths, these previous studies present with several limitations. For example, Faith and colleagues (2002) relied on self report height and weight data to calculate BMI for each participant. Studies have demonstrated that many children and adolescents are poor reporters of this data, often under reporting their weight (Elgar, Roberts, Tudor-Smith, & Moore, 2005). Additionally, one study

reported that 10% of children in a sixth-grade sample were unable to specify a value for weight, height, or both (Shannon, Smicilas-Wright, & Wang, 1991). One weakness of the study by Storch and colleagues (2007) is that it assessed peer victimization broadly rather then assessing the impact of criticism from peers *during* physical activity. While general victimization appears to impact physical activity, the mechanisms of the weight criticism-physical activity relationship may be better understood when the context of peer criticism coincides with physical activity.

Although a negative correlation between physical activity and weight-related criticism has been demonstrated in several studies, little is known about variables that may influence or explain the impact of weight criticism on physical activity. One potential moderator between weight criticism and physical activity is body dissatisfaction. Research has demonstrated the role of body dissatisfaction in many psychological domains (see Wood, Becker, & Thompson, 1996, for a review). Although most studies have not tested for moderating effects, they provide evidence that body dissatisfaction is an important correlate of many deleterious psychological problems.

For example, Erickson, Robinson, Haydel, and Killen (2000) found a significant correlation between concerns about weight (a construct similar to body dissatisfaction) and depressive symptoms, reporting a higher incidence of depressive symptoms among children with many concerns about their body shape and weight when compared to children with fewer weight concerns. Similarly, Friedman, Reichmann, Costanzo, and Musante (2002) demonstrated that body image partially

mediates the relationship between obesity and psychological distress such that poorer body image partially accounts for the correlation between obesity and psychological distress. These researchers also reported that body dissatisfaction is directly related to negative affect and low self-esteem. Several authors have also found that increased body dissatisfaction is associated with lower self esteem in preadolescent children (Gardner et al., 1999; Wiseman, Peltzman, Halmi, & Sunday, 2004). These relationships between body dissatisfaction and psychological constructs suggest that body dissatisfaction may contribute substantially to psychological health and behavior.

Rationale for Present Study

The primary purpose of the current investigation was to examine the role of body dissatisfaction in the association between weight-related criticism and physical activity. Previous studies have documented the association between weight related criticism and physical activity (e.g., Faith et al., 2005; Storch et al., 2007). However, fewer studies have explored the mechanisms or moderators of these relationships. Such investigations are important when designing obesity prevention programs, providing important information about ways to minimize the effects of criticism from peers on physical activity. Body dissatisfaction is a particularly promising potential moderator because previous studies have demonstrated that body dissatisfaction is a moderator between weight-related variables and physical and psychological health (e.g., Friedman et al., 2002). It was hypothesized that body dissatisfaction would moderate the relationship between weight-related criticism and physical activity, such

that the inverse relationship between weight-related criticism and physical activity would be stronger among children who report high levels of body dissatisfaction.

A secondary purpose of this investigation was to examine whether BMI would moderate the relationship between weight-related criticism and physical activity using more precise measurement than had previously been employed. As noted above, Faith and colleagues (2002) demonstrated that, as BMI increases, weight related criticism also increases. However, one weakness of this study was the use of self-reported height and weight data as indicators of BMI. As noted previously, the reliability of self-reported height and weight data provided by preadolescent children is poor. The present study addresses this limitation by using school nurse-collected height and weight to calculate BMI for each participant. Consistent with Faith et al. (2002), it was hypothesized that BMI would moderate the relationship between weight-related criticism and physical activity when school BMI data are used, such that the inverse relationship between weight-related criticism and physical activity will become stronger as BMI increases. This examination will allow for more precise evaluation of the potential moderating effects of BMI in this association.

Method

Participants

A volunteer sample of 376 participants was recruited through the Lawrence Public School District. Eligibility criteria for participation in the investigation included 1) the child was enrolled in either fifth- or sixth-grade, 2) the student speaks and reads English, and 3) the child's parent or custodial caregiver provided informed

consent for participation. All students meeting these criteria were deemed eligible regardless of weight status, sex, or ethnicity. Demographic analyses indicated that 53.9% of the sample was male. Ethnic composition of the sample was as follows: 59.2% White, 6.6% Black, 9.7% Hispanic, 5.8% Asian, 6.3% Native American, 10% Other, and 2.1% Biracial. Individual information regarding socio-economic status was not available; however, 43.32 percent of children attending the schools sampled qualified for free and reduced lunch while the agregate school district percentage was 32.13 percent.

Measures

Body Dissatisfaction. Body dissatisfaction was measured using a pictorial scale displaying seven figure drawings of children (both male and female) along a continuum from 1 (extremely thin) to 7 (obese; Collins, 1991). Children were asked to use the scale appropriate to their respective sex to identify their current body size and their ideal body size. This commonly used measure was validated among pre-adolescent children (*M* age = 8 years; Collins, 1991) with accuracy reported to increase with age. Adequate test-retest reliability was reported for actual self and ideal self (respectively, $r = .71$, $r = .59$). Criterion-related validity was assessed by comparing figure selection with BMI ($r = 0.37$, $p < .05$; Collins, 1991). For purposes of this study, the difference between actual and ideal (actual - ideal) body perception was used to indicate body dissatisfaction. Positive scores indicated a desire to be thinner while negative scores suggested a desire to be larger.

Physical and Sedentary Activity. Physical and sedentary activity was

measured using the Self-Administered Physical Activity Checklist (SAPAC; Sallis et al., 1996). The SAPAC is a self-report measure developed for use with pre-adolescent children that consists of a list of 21 different physical activities, and allows children to report their engagement in physical activities before, during, and after school. Additional spaces are provided for reporting activities not appearing on the questionnaire. Each activity is also assigned a unit of metabolic activity (MET), allowing the reported physical activities to be divided into either vigorous or moderately vigorous physical activity categories. Reliability was assessed by comparing self-report and interview format reports (Sallis et al., 1996). This comparison yielded correlations of $r = .64$ to $r = .79$. Sallis and colleagues (1996) also demonstrated that the self report SAPAC was moderately and significantly correlated with objective measures of physical activity (E.G., heart rate monitor, $r = .59$, accelerometer, $r = .32$).

In its original development, this measure required children to report one-day recall of minutes engaged in each activity as well as subjective levels of intensity. In order to develop a broader profile of activity and to avoid reported recall issues related to duration and intensity, this measure was modified in the following areas: (a) children were not required to report minutes engaged in activity, (b) children were not asked to give subjective reports of intensity, and (c) children were asked to report activity engagement over a three day period.

Body Mass Index. Participants' height (in) and weight (lbs) were collected by school nurses as part of a district-mandated health assessment conducted during the

first quarter of the academic year. This information was then provided to study personnel by the school district for all consenting participants. Using height and weight values, Body Mass Index was calculated for each individual according the following formula: weight (lb) / [height (in)]^2 x 703 (Centers for Disease Control and Prevention, 2007).

Weight Criticism during Physical Activity. This construct was measured using a six item measure of weight criticism during physical activity (WCA) developed by Faith and colleagues (2002) that employed the Perceptions of Teasing Scale (Thompson, Cattarin, Fowler, & Fisher 1995) as a prototype. This instrument asks questions about the child's experiences with teasing during participation in physical activity (e.g., "People make fun of you when you play sports or exercise;" Faith et al., 2002). Children rate the frequency that they have encountered this teasing on a five point scale from 1 (never) to 5 (very often). If the child has experienced the particular type of teasing, they are asked to rate to what degree it bothered them on a five point scale from 1 (not upset) to 5 (very upset). This scale was originally tested with fifth through eighth grade children (Faith et al., 2002). Internal consistency for this measure has been reported to be good ($\alpha = .83$) and scores have been shown to correlate with the Perceptions of Teasing Scale ($r = .40$; $p < .001$; Faith et al., 2002). Internal consistency in the present study was also high ($\alpha = .88$).

Procedure

Parents of students in grades 5 and 6 at selected schools were sent information about the study and a form on which they were asked to indicate consent

or non-consent for their child's participation. In order to encourage children to return consent forms, a prize was awarded to classes with 80% (or more) consent form return rate, regardless of whether parental consent or non-consent was indicated. Classes with 80% of forms returned received a 15-minute visit from the KU Jayhawk mascot. Children whose parents indicated consent were gathered together in a cafeteria or classroom during a convenient time determined by school personnel. Research assistants distributed questionairre packets to each student. Each packet and the measures contained therin were identified with a unique study number. The assent script (see Appendix) was then read to the participants and the researcher requested that each participant indicate assent or non-assent by circling either "yes" ro "no" on the form. After assenting, participants were asked to write their name on a page that was removed from the rest of the packet (this was used to link BMI data with measure responses). Students were then asked to complete a packet of measures regarding psychological, social, and physical functioning (see Appendix). Research assistants read each measure aloud to the students to ensure comprehension of each question. Data regarding height and weight for use in BMI calculation were obtained from the student's school records by school nurses. These procedures were approved by the University of Kansas Human Subjects Committee-Lawrence (HSC-L; Approval #16672).

Statistical Methods

Preliminary Analyses. First, independent samples t-tests were performed to examine sex differences on the outcome variable, physical activity. Analyses were

conducted for both vigorous and moderately vigorous activity levels.

Tests for sex differences revealed that amount of vigorous physical activity was significantly higher among boys than girls while moderately vigorous activity did not differ across gender. Because of this gender difference and because of earlier findings reporting a similar difference (Faith et al., 2002), all regression analyses were conducted separately for boys and girls. Additionally, separate analyses were conducted for each physical activity intensity level (moderately vigorous, vigorous).

Next, one-way ANOVAs were conducted to determine whether weight criticism during physical activity, body dissatisfaction, and physical activity differed across age or ethnicity group. Demographic variables that were significantly associated with study variables were retained for inclusion in the planned analyses.

Finally, because Faith and colleagues (2002) demonstrated that several of the variables of interest were non-normal in a previous study, an examination of data normality was conducted. Results suggested that physical activity (PA) and body dissatisfaction (BD) were reasonably normal; however, weight criticism during physical activity (WCA) was positively skewed. Subsequently a log transformation (Tabachnick & Fidell, 2001) was applied to this variable to reduce the degree of skewness, a procedure consistent with Faith and colleagues (2002). The transformed variable was highly correlated with the untransformed variable, based on a Pearson product moment correlation with a .05 significance level ($r = .953$, $p < .001$). Because the results of the regression analysis were more easily interpretable with WCA in its original units, the log transformed WCA variable was antilogged (estimates returned

to the original scale) prior to conducting further analyses (see Tabachnick & Fidell, 2001).

Primary Analysis. Hierarchical multiple regression analyses were used to examine the hypothesis that body dissatisfaction (BD) moderates the association between weight criticism during physical activity (WCA) and physical activity (PA). In order to mitigate possible multicollinearity between main effects and interaction terms, Little, Bovaird, and Widaman (2006) recommended creating an orthogonalized interaction term for inclusion in the analyses. To accomplish this, a multiplicative interaction term was first created from the WCA and BD scores (*WCA x BD*). Next, this interaction term was regressed on both first-order effect variables. The residuals from this regression analysis were retained for use as the orthogonalized interaction term. A three step multiple regression analysis was then conducted with PA as the dependent variable. First, Weight Related Criticism was entered into the regression equation followed by Body Dissatisfaction in step 2. Finally, the orthogonalized multiplicative interaction term (*WRC x BD*) was entered in step 3. Moderation is indicated by a significant interaction term. Follow-up analyses, as recommended by Aiken and West (1991) and Holmbeck (1997), were conducted to determine the exact nature of the interaction.

Secondary Analysis. Hierarchical regression analyses were conducted to examine the secondary hypothesis that BMI percentile moderates the relationship between WRC and PA. Main effect terms (WRC and BMI) were entered as step 1 and step 2 of the regression analysis, followed by the orthogonalized multiplicative

interaction term (*WRC x BMI*) in step 3.

Results

Descriptive Data

First, an independent t-test revealed that amount of vigorous physical activity was significantly higher among boys than girls, t(1,380) = 2.89, p=.004. However, moderately vigorous physical activity did not vary based on gender. Next, one-way ANOVAs were conducted to determine whether ethnic or age differences in physical activity were present. The test for racial differences revealed that there were no significant differences in physical activity among racial groups. Similarly, the ANOVA examining age differences in physical activity confirmed that no age differences were present.

Body Dissatisfaction as a Moderator of the WCA-PA Relationship

Girls. Results indicated that, among girls, Body Dissatisfaction predicted vigorous physical activity, $\Delta R^2 = .047$, $F(1,171) = 4.23$, $p = .016$. This finding suggests that as body dissatisfaction increased among girls, physical activity also increased. Weight criticism during physical activity was not a significant predictor of physical activity for girls. However, the interaction between body dissatisfaction and weight criticism during physical activity was a significant predictor of physical activity, $\Delta R^2 = .022$, $F(1,168) = 4.208$, $p = .007$, such that among girls who reported higher body dissatisfaction, the association between WCA and PA was negative (See Figure 1 and Table 2).

Results from the regression analysis conducted using moderately vigorous

physical activity as the outcome variable revealed that no significant relationships existed between WCA and moderate PA or between BD and moderate PA. Similarly, the interaction term (*WCA x BD*) was not significant in this analysis. Collinearity statistics for these analyses were all in the acceptable range based on tolerance values and variance inflation factors (i.e. all > .91 , all < 1.09, respectively).

Boys. Analyses conducted for boys in the present sample revealed no significant relationships between WCA and vigorous PA or between BD and vigorous PA. The interaction term in this regression equation (*WCA x BD*) was also not significant. Similarly, the second regression analysis for boys, using moderate PA as the dependant variable, revealed no significant associations among the variables. Collinearity statistics for these analyses were all in the acceptable range based on tolerance values and variance inflation factors (i.e. all > .91 , all < 1.09, respectively).

BMI Percentile as a Moderator of the WCA-PA Relationship

Likewise, a hierarchical regression analysis was conducted to examine the secondary hypothesis that BMI percentile moderates the relationship between WCA and PA. This analysis revealed that neither BMI nor WCA was significantly associated with vigorous or moderate physical activity among girls or boys. Additionally, no significant interaction effect was present for either sex group. Thus, none of the hypothesized effects for BMI percentile was confirmed.

Discussion

This study examined the associations between weight criticism during physical activity, body dissatisfaction, and self-reported physical activity among

preadolescent children. Consistent with the original hypothesis, the inverse relationship between criticism during physical activity and vigorous physical activity was stronger for girls who experienced greater body dissatisfaction. However, this relationship did not exist for boys. Although the correlational nature of this study prevents causal claims, this result suggests that body dissatisfaction may strengthen the effects of criticism during physical activity for girls who are dissatisfied with their body shape. Among girls, body dissatisfaction was a particularly influential factor associated with vigorous activity participation: Girls who reported low body dissatisfaction had minimal change in vigorous activity as a result of weight criticism level, while those indicating high body dissatisfaction and weight criticism reported participating in three and one-half fewer activities (five minutes or more, three day recall) on average when compared to those with high body dissatisfaction and low weight criticism. When one considers that each reported activity was at least 5 minutes in duration, these results suggest a difference in vigorous physical activity of about 41 minutes per week. This finding is particularly significant in light of recommendations that children should engage in 30 to 60 minutes of physical activity per day to prevent overweight or obesity (Saris, Blair, van Baak, Eaton, Davies, De Pietro, et al., 2002). A difference of approximately a day's worth of physical activity each week between high and low body dissatisfaction groups suggests that significant health consequences may be associated with body dissatisfaction.

The secondary hypothesis, postulating that BMI percentile would also moderate the relationship between weight criticism and physical activity, was not

supported. This relationship was expected because Faith and colleagues (2002) demonstrated a relationship between BMI and weight criticism while many studies have reported lower levels of physical activity associated with increased BMI. However, in this study physical activity was not associated with BMI, a factor that may have prevented BMI percentile from helping to explain the weight criticism-physical activity relationship. Additionally, the use of self report for both BMI and physical activity data in Faith and colleagues study may have led to common method variance that may have led to overestimation of the relationship. Finally, other studies establishing an association between BMI and physical activity (Jago et al., 2005; Moore et al., 2003) have used longitudinal changes in activity to predict BMI while this study relied on cross sectional data, perhaps obscuring a physical activity-BMI relationship.

Similar to Faith and colleague's (2002) findings, this study suggests that weight criticism during physical activity is not associated with lower physical activity levels. Rather, children who received more criticism from peers engaged in higher levels of vigorous and moderate activity, although these differences were not statistically significant. This finding may be explained by studies that have demonstrated an increase in child weight loss attempts associated with more frequent negative comments about weight from mothers (Slomak, Levine, & Schermer, 1999). Perhaps a similar mechanism is at work among child peer groups. Additionally, Faith et al. suggested that the context in which weight criticism occurs may influence activity level. They hypothesized that criticism that is not tied to contextual cues

connected to physical activity may motivate children to increase their physical activity. Another potential explanation is presented by the significant interaction between body dissatisfaction and weight criticism when predicting physical activity. Results from this study suggest that children who are criticized by peers but are satisfied with their body shape may be somewhat protected from the possible negative effects of criticism, specifically reduction in physical activity level.

Another interesting result of this investigation is that the interaction between body dissatisfaction and weight criticism is associated with a decrease in vigorous physical activity but not moderately vigorous physical activity among girls. This result may be due to variation in situational factors that could lead to higher risk for peer criticism. Activities requiring a child to wear specific clothing (e.g., swimming, basketball) or to perform in front of others may increase the likelihood of weight criticism, potentially reducing motivation to participate. Alternatively, this finding may be a result of the routine nature of moderate activity in comparison to vigorous activities. Many moderate activities are not optional for some children (e.g. walking to school, doing housework), while many vigorous activities are engaged in by choice. Perhaps those who experience more body dissatisfaction and weight criticism elect not to participate in optional activities while mandatory activity remains unchanged. Future studies could provide further insight into individual and social factors that influence children's decisions to participate in activities of varying intensity levels.

The differences in relationships between study variables for girls and boys are

not surprising in light of past literature confirming sex differences on several of the constructs of interest (see Gardner, Sorter, & Friedman, 1997). Faith et al. (2002) reported that girls endorsed higher levels of weight criticism than did boys. Results from the current study also indicated a significant sex difference, with girls experiencing more weight criticism and body dissatisfaction than boys. However, reports from a recent study indicated that weight criticism/peer victimization does not differ as a result of sex group (Storch et al., 2007). A potential explanation for this difference is that Storch and colleagues conducted their investigation with only overweight or at-risk for overweight youths while the present study included all children willing to participate, regardless of body size. Perhaps children of similar weight status perceive similar criticism, regardless of sex, while gender has more influence on perceptions of criticism across weight categories. Additionally, these differences may be explained by increased awareness about body size and poor body image among girls. In a review of body dissatisfaction studies, Ricciardelli and McCabe (2001) reported that between 28 and 55 percent of preadolescent girls (ages 6-11) desire a thinner body shape while 17 to 30 percent of boys reported being dissatisfied with their bodies. These results suggest that body shape may be more important to preadolescent girls than boys of similar age.

Building on the work of other investigators, this study adds several unique pieces of information to the literature. First, Storch and colleagues (2007) and Faith and colleagues (2002) demonstrated that physical activity is influenced by victimization and weight criticism. This study provides some insight into potential

mechanisms of this relationship: Weight criticism appears to be more salient to girls who are dissatisfied with their physical appearance than to those who perceive their bodies as satisfactory. This finding suggests that efforts to decrease body dissatisfaction may attenuate the negative effects of victimization and criticism on physical activity.

Second, the finding that BMI percentile did not help explain the weight criticism-physical activity relationship indicates that overweight children are not the only group that may experience ill effects from weight criticism during physical activity. While Storch and colleagues (2007) reported an association between peer victimization and a global measure of activity (i.e. number of days with at least 60 minutes of activity over the past week) in treatment-seeking overweight or obese youths, Faith and colleagues only found significant associations between weight criticism and mild leisure activity in a community sample. This study provides evidence that weight criticism, when combined with body dissatisfaction, may lead to significant reductions in vigorous physical activity, regardless of weight status.

Finally, findings of this study emphasize the importance of body dissatisfaction in a child's propensity to engage in physical activity. While girls who had low body dissatisfaction were nearly unaffected by weight criticism (activity levels actually increased slightly with increased criticism, see figure 1), those with high body dissatisfaction and high weight criticism showed markedly lower activity levels. Results suggest that body dissatisfaction plays a critical role in physical activity engagement.

The findings of this study have important practical implications, particularly when designing prevention programs intended to increase rates of physical activity among youths. Efforts to increase vigorous physical activity among children may be augmented by initiatives designed to decrease body dissatisfaction, particularly among girls. While many existing interventions designed to reduce body dissatisfaction have proven efficacious among adolescents with eating disorders, few have addressed this issue with overweight girls. However, a recent investigation of a web-based intervention for body dissatisfaction designed for girls ages 8-18 who had either body dissatisfaction or eating problems demonstrated positive changes in body dissatisfaction (Zabinski, 2008). Efforts to decrease body dissatisfaction among preadolescent girls may be particularly important because research has demonstrated that body dissatisfaction increases with age in 9 to 14 year old girls (Gardner, Friedman, & Jackson, 1999). Extending the current literature, the present study demonstrated that body dissatisfaction is an important factor in physical activity among 10-12 year-old girls.

Results from this study also lend support to prevention and intervention efforts aimed at decreasing peer victimization and teasing (Olweus, 1993; Twemlow et al., 1999). These peer victimization prevention programs, however, do not specifically address weight related teasing, perhaps an element that could be included in school-based interventions. Population-based efforts to reduce relational aggression may have the added benefit of potentially increasing (or at least counteracting decreasing) levels of physical activity among school children. Findings

from this study indicate that girls with high body dissatisfaction and weight criticism also engage in substantially lower levels of activity than less-criticized peers, suggesting that efforts to reduce teasing could have significant health benefits. Future studies evaluating the effects of peer victimization prevention programs on physical activity levels would provide valuable insight into potential health benefits of victimization reduction efforts.

This study has a number of strengths, including a relatively large sample size, the use of empirically-obtained height and weight measurements for BMI percentile computation, and measurement of criticism from peers *during* physical activity. Additionally, the present investigation employed a more comprehensive evaluation of child physical activity than used in previous studies. The inclusion of a three-day measure that is intensity-specific is a significant strength.

Several limitations were also present in this investigation, many of which prompt directions for further study. First, the cross-sectional nature of the data prevents causal claims and leaves questions about the development of body dissatisfaction in relation to weight criticism and physical activity unclear. While the results of this study provide evidence for interaction effects, it is unclear whether these effects have significant effects on weight status over time. Longitudinal studies could effectively examine the potential negative effects of body dissatisfaction and weight criticism during physical activity over time. Investigations of the factors influencing physical activity over time would be valuable. Second, reliance on self-reported physical activity precludes definitive claims about the child's actual physical

activity level. Although this is common practice in many studies (Faith et al., 2002; Storch et al., 2007), a more accurate assessment of individual physical activity levels (e.g., accelerometer, heart rate monitor) could improve future studies.

Conclusion

In light of the previous literature examining predictors of physical activity in children (Faith et al., 2002; Storch et al., 2007), the current study is important for a number of reasons. First, the results of this study demonstrate that, for girls, the inverse relationship between weight criticism during physical activity and physical activity becomes stronger as body dissatisfaction increases. Preadolescent girls who report high body dissatisfaction and weight criticism engage in significantly fewer vigorous physical activities than girls who are satisfied with their bodies. Second, the results highlight an additional detrimental effect of peer victimization: Criticism from peers is associated with lower levels of physical activity for girls, particularly those dissatisfied with their bodies. Finally, these findings lend support to intervention and prevention efforts designed to foster healthy body image and decrease weight-related criticism among preadolescent girls.

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Table 1

Means(SD), Ranges, and Frequencies of Demographic and Primary Study Variables.

Variable	Mean (SD)	Range	Frequency (%)
Age of child	10.80 (.654)	9 - 12	
Weight Criticism	13.22 (8.432)	0 - 53	
Body Dissatisfaction	.33 (.751)	-2 - 4	
Vigorous Physical Activity	17.654 (12.488)	0 - 63	
Moderately Vigorous Activity	18.942 (13.424)	0 - 83	
Ethnicity			
Caucasian			59.2
African-American			6.6
Hispanic			9.7
Asian			5.8
Native American			6.3
Biracial			2.1
Other			10.0

Table 2

Summary of hierarchical multiple regression analyses.

Dependent Variable and Block	B	SE B	β	ΔR^2	ΔF
Vigorous Physical Activity - Girls					
Step 1 (Weight Criticism)				.00	.03
Weight Criticism Total Score	-.04	.09	-.03		
Step 2 (Body Dissatisfaction)				.047	8.42*
Body Dissatisfaction Total Score	3.73**	1.12	.27		
Step 3 (Orthogonalized Interaction)				.02	4.02*
Weight Criticism* Body Dissatisfaction	-.16*	.08	-.16		
Vigorous Physical Activity - Boys					
Step 1 (Weight Criticism)				.00	.12
Weight Criticism Total Score	.08	.15	.04		
Step 2 (Body Dissatisfaction)				.00	.09
Body Dissatisfaction Total Score	1.02	1.58	.05		
Step 3 (Orthogonalized Interaction)				.00	.58
Weight Criticism* Body Dissatisfaction	.14	.18	.07		
Moderately Vigorous Physical Activity - Girls					
Step 1 (Weight Criticism)				.00	.00
Weight Criticism Total Score	-.06	.10	-.04		
Step 2 (Body Dissatisfaction)				.03	4.46*
Body Dissatisfaction Total Score	2.81*	1.28	.18		
Step 3 (Orthogonalized Interaction)				.00	.40
Weight Criticism* Body Dissatisfaction	-.06	.89	-.05		
Moderately Vigorous Physical Activity - Boys					
Step 1 (Weight Criticism)				.00	.21
Weight Criticism Total Score	.09	.16	.04		
Step 2 (Body Dissatisfaction)				.00	.45
Body Dissatisfaction Total Score	1.52	1.68	.07		
Step 3 (Orthogonalized Interaction)				.00	.41
Weight Criticism* Body Dissatisfaction	.13	.20	.06		

Vigorous Physical Activity - Girls					
Step 1 (Weight Criticism)				.00	.03
Weight Criticism Total Score	.01	.09	.01		
Step 2 (BMI Percentile)				.00	.08
Body Mass Index Percentile for Age	.01	.03	.04		
Step 3 (Orthogonalized Interaction)				.00	.88
Weight Criticism* BMI Percentile	-.00	.00	-.07		
Vigorous Physical Activity - Boys					
Step 1 (Weight Criticism)				.00	.00
Weight Criticism Total Score	-.01	.14	-.00		
Step 2 (BMI Percentile)				.00	.14
Body Mass Index Percentile for Age	.01	.03	.03		
Step 3 (Orthogonalized Interaction)				.00	.01
Weight Criticism* BMI Percentile	.00	.00	.00		
Moderately Vigorous Physical Activity - Girls					
Step 1 (Weight Criticism)				.00	.00
Weight Criticism Total Score	-.00	.10	-.00		
Step 2 (Body Dissatisfaction)				.00	.01
Body Mass Index Percentile for Age	-.00	-.03	-.01		
Step 3 (Orthogonalized Interaction)				.00	.08
Weight Criticism* BMI Percentile	.00	.00	.02		
Moderately Vigorous Physical Activity - Boys					
Step 1 (Weight Criticism)				.00	.09
Weight Criticism Total Score	-.03	.14	-.02		
Step 2 (BMI Percentile)				.00	.16
Body Mass Index Percentile for Age	-.02	.04	-.04		
Step 3 (Orthogonalized Interaction)				.00	.64
Weight Criticism* BMI Percentile	.-.00	.00	-.06		

*$p \leq .05$; **$p \leq .01$

Figure 1

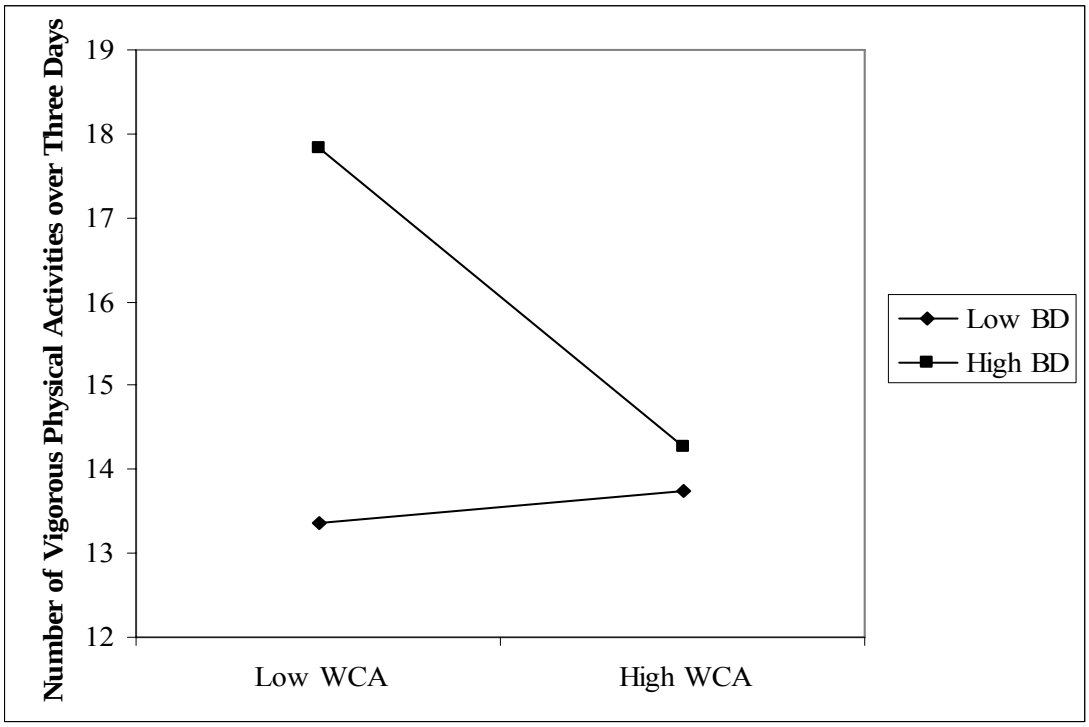

Figure 1. Relationship between vigorous physical activities over a three-day period and weight criticism during physical activity for girls "high" and "low" in body dissatisfaction.

Appendix

The University of Kansas

Clinical Child Psychology Program

CHILD ASSENT FORM

Attitudes and Activities Project

To be read to the children in each participating classroom:

I am interested in finding out more about what children think about themselves and others. I am also interested in what kinds of activities children your age like to do and why you like to do them. I have prepared a bunch of questions. Some are just about different things you may have done the last few days, but some are more personal and ask about your feelings and experiences. I will be happy to answer any questions you may have now or while you are completing the forms. You are free to skip any questions that make you feel uncomfortable or to stop and go back to class at any time. Do you want to take part in this project?

Child's response:

Do you want to take part in this project? (circle one)	**Yes**	**No**

Date: _____

Researcher Signature: _____

Researcher Name (Printed): _____

Attitudes and Activities Project

We are interested in knowing more about what children your age think about themselves and others as well as what kinds of activities you like to do. If we ask you to answer a question that you are not comfortable answering, you may skip it and go to the next question. You are free to stop answering questions and go back to class at any time.

Please answer all questions as honestly as possible. We will keep the answers that you provide to us confidential. That means we won't tell anyone anything you have written, unless we think you are in danger. If you are in danger, then we would want to talk to someone who makes you safer. Also, please respect your friends' privacy by not asking their answers to the different questions.

Please let us know if you have any questions about the project, or why we want this information. If you have any questions about this project after we are finished you may contact us through you teacher or principal.

PLEASE TELL US A BIT ABOUT YOURSELF:

Grade:	_____	
School:	_____	
Birthday: (month/day/year)	_____ *Example: 02/15/1997 or February 15, 1997*	
Age:	_____	
Sex (circle one):	Male Female	
Race (circle one):	White (non-Hispanic)	Black (non-Hispanic)
	Hispanic	Asian
	Native American	Other

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Please let us know how many of the **past three days** you did each activity **for more than five minutes**.

Activity	Before School				During School				After School			
Bicycling	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days
Swimming Laps	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days
Gymnastics: Bars, beams, tumbling, trampoline	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days
Exercises: Push-ups, sit-ups, jumping jacks	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days
Basketball	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days
Baseball/Softball	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days
Football	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days
Soccer	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days
Volleyball	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days
Racquet sports: Badminton, tennis	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days

Ball Playing: Four square, dodgeball, kickball	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days
Games: Chase, tag, hopscotch	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days

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Activity	**Before School**				**During School**				**After School**			
Outdoor Play: Climbing trees, hide and seek	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days
Water play (in swimming pool, ocean, or lake)	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days
Jump Rope	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days
Dance	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days
Outdoor chores: Mowing, raking, gardening	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days

Indoor chores: Mopping, vacuuming, sweeping	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days
Mixed walking/running	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days
Walking	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days
Running	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No Days

Are there any physical activities you did in the last 3 days that we forgot?

Other Activities	**Before School**				**During School**				**After School**			
	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days
	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days
	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days	1 day	2 days	3 days	No days

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Below are situations that kids your age could experience. Please circle how often you have had the experience from kindergarten until now. If you have had the experience, please circle how much it upset you. **If you have never experienced the situation, please do not circle how much it upset you.**

1a. People make fun of you when you play sports or exercise.	1 Never	2	3 Sometimes	4	5 Very Often
1b. If this happens to you, how upset are you?	1 Not Upset	2	3 Somewhat Upset	4	5 Very Upset
2a. People call you insulting names when you play sports or exercise.	1 Never	2	3 Sometimes	4	5 Very Often
2b. If this happens to you, how upset are you?	1 Not Upset	2	3 Somewhat Upset	4	5 Very Upset
3a. People look at you funny in your gym or sports clothes when you play sports or exercise.	1 Never	2	3 Sometimes	4	5 Very Often
3b. If this happens to you, how upset are you?	1 Not Upset	2	3 Somewhat Upset	4	5 Very Upset
4a. People put down (criticize) your physical skills when you play sports or exercise.	1 Never	2	3 Sometimes	4	5 Very Often
4b. If this happens to you, how upset are you?	1 Not Upset	2	3 Somewhat Upset	4	5 Very Upset
5a. People don't choose you for their teams when you play sports or exercise.	1 Never	2	3 Sometimes	4	5 Very Often
5b. If this happens to you, how upset are you?	1 Not Upset	2	3 Somewhat Upset	4	5 Very Upset
6a. People look upset when you get selected to be on their team during sports or exercise.	1 Never	2	3 Sometimes	4	5 Very Often
6b. If this happens to you, how upset are you?	1 Not Upset	2	3 Somewhat Upset	4	5 Very Upset

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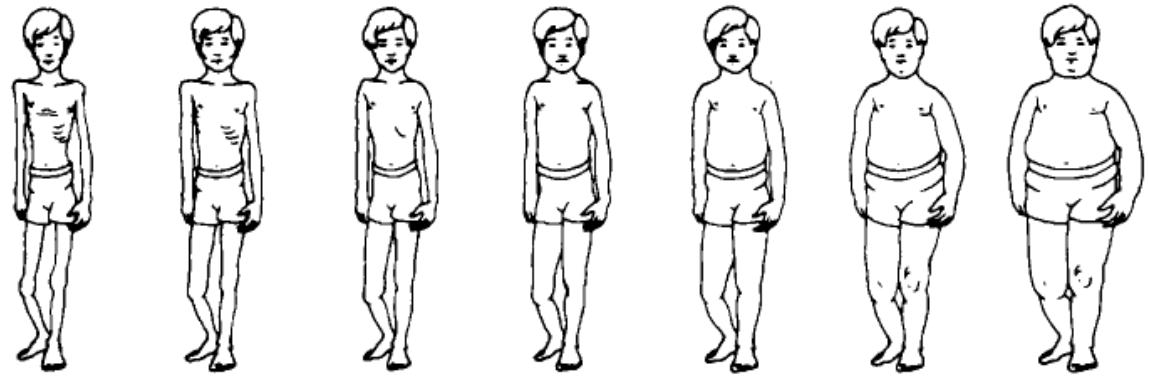
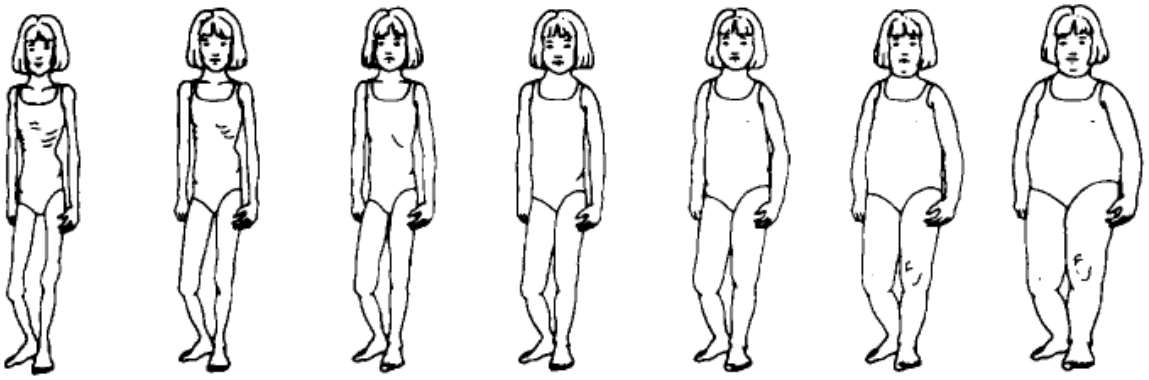
Which picture looks most like you?

(If you are a boy, circle only one of the boy pictures. If you are a girl, circle only one of the girl pictures.)





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Which picture shows the way you want to look?

(If you are a boy, circle only one of the boy pictures. If you are a girl, circle only one of the girl pictures.)